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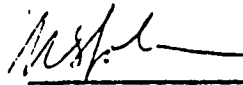
SPACE FLIGHT OPERATIONS
MEMORANDUM

RANGER II

EPD-69

5 February 1962

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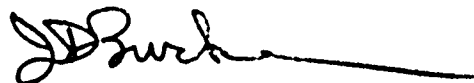


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DISTRIBUTION LIST, SFOM, RANGER II

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I. INTRODUCTION

A. Purpose

The purpose of the Space Flight Operations Memorandum (SFOM) is to summarize, on the basis of the information available at the time of publication, the following:

- 1) Performance of the Space Flight Operations Complex (SFOC).
- 2) Participation of the various tracking facilities involved.
- 3) Analysis of the telemetry data received.
- 4) Spacecraft performance.
- 5) Orbital data.

B. Summary

Ranger II was launched from AMR Cape Canaveral on Saturday, 18 November, 1961, aboard an Atlas/Agena vehicle. Liftoff was 08 hrs. 12 min. 21.502 sec. GMT (03 hrs. 12 min. 21.502 sec. EST). Atlas performance was apparently normal. The reported times of ignition and cutoff for the first Agena burn were normal; however, preliminary reports indicate that the Agena was rolling at an excessive rate during this period. Confirmation of this was obtained from the spacecraft gyro measurements on the AMR telemetry records.

A near nominal parking orbit was achieved but since no second Agena burn was reported, the DSIF prepared to track the spacecraft in a low satellite orbit similar to Ranger I. The initial orbit had a period of 88.31 minutes, apogee of 147.2 statute miles and perigee of 97.5 statute miles.

Confirmation of mechanical separation of spacecraft and Agena was obtained from Agena telemetering on the second pass over AMR. Electrical separation was verified by the fact that the programmed controller commands were executed. There was nothing in the telemetry data to indicate that the spacecraft did not perform in a manner normal for a low, Earth satellite orbit. The Mobile Tracking Station (DSIF 1) provided most of the tracking and telemetry data obtained. After the 5th pass the orbit was below the MTS horizon and no further passes were tracked. Preliminary estimates placed the time of re-entry at 0400 GMT on the 19th.

II. SPACE FLIGHT OPERATIONS COMPLEX

The performance of the Space Flight Operations Complex was most satisfactory. The experience gained tracking Ranger I and that gained during the RA-2 operational tests was very much in evidence in the manner in which the Operations Complex responded to the nonstandard situation.

III. TRACKING PARTICIPATORS

A. General

The participators tracking Ranger II were the Atlantic Missile Range (AMR), the JPL Launch Checkout Telemetry Trailer (LCTT), the Launch Operations Directorate (LOD), the North American Air Defense Command (NORAD), and the Deep Space Instrumentation Facility (DSIF). Tracking participation divides operationally into launch-to-injection and postinjection phases and the participation and performance of each tracking facility is described under its appropriate phase below.

B. Liftoff-to-Injection

1. AMR Participation in Tracking Ranger

The AMR was assigned the responsibility of providing JPL with 1) orbital elements of the parking and transfer orbits, 2) acquisition angles for DSIF 1 and 5, and 3) raw data for the backup role by JPL.

During the ascent phase, the vehicle was tracked by AMR. The parking orbit was established by AMR using data from San Salvador rather than Antigua because of the poor quality of the data received from the latter. Excellent tracking data from Ascension Island was received at AMR and JPL in real time. (The preliminary indication that the second Agena burn had not occurred was obtained from this data.)

Assuming a nominal second burn of the Agena, acquisition data for the DSIF was provided by AMR prior to acquisition by DSIF 1, 5. Table I presents the orbital parameters determined by using Antigua, Ascension, and DSIF 1 tracking data. (Mechanical separation of Ranger II and the Agena was confirmed by Agena telemetry received at AMR on Orbit 2.)

2. JPL Launch Checkout Telemetry Trailer (LCTT)

Only one pass of Ranger II was tracked by the LCTT because of the low orbit of the spacecraft. No commands were sent by the LCTT nor were any interrogations made. The LCTT acted only as a receiver for one pass.

C. Postinjection

1. Deep Space Instrumentation Facility (DSIF)

Using data provided by AMR, DSIF achieved one-way lock on the transponder at 0844 38 GMT. It became apparent from the DSIF 1 tracking data that Ranger II had not achieved the standard trajectory. DSIF 1 lost lock at 0850 56 GMT. As mentioned in paragraph B.1. above, the data acquired during the 6 minutes of DSIF tracking combined with that obtained from Antigua and Ascension was used to determine the orbital parameters given in Table I. The mutual compatibility of all data in this orbit clearly indicates that any thrust that may have been applied during the nominal second burn period lies within the uncertainty inherent in the tracking data. Acquisition information based on this orbit was provided DSIF 3 by the CCF. Acquisition by DSIF 3 at 0938 56 GMT confirmed that Ranger II was still in the parking orbit.

TABLE I. 1
TRACKING CHART

DATE	STA	ORB	R.F. ONE-WAY			R.F. TWO-WAY			AUTOTRACK			SIGNAL	
			IN	OUT	T _{OT}	IN	OUT	T _{OT}	IN	OUT	T _{OT}	DBM	TIME
11/18/61	-	-											
	1	1	084438	084830		084830	085056		084445	085056		-114 to -121	
	5	1	084642	084656		-	-		-	-		-	
	2	1	094011	094021								-130(max.)	
	3	1	093856	094446					093923	094446		-125	
	1	2	101708	101721		101721	102339		101741	102301		-114	
	5	2	-	-		-	-		-	-		-	
	3	2	111354	111405									
			111438	111442									
			111521	111527									
			111543	111611									
	2	2											
	1	3	115025	115051		115051	115653		115051	115610		-115	115051
	5	3											

The MTS (DSIF 1) tracked all visible passes from its initial acquisition through Orbit 5 until approximately 1500 GMT November 18, 1961. No information was obtained from Ranger II after that time. Table II summarizes preliminary information about the DSIF tracking. The next orbit visible at a DSIF station was Orbit 11. Woomera searched for Ranger II on Orbits 11 through 14 inclusive. DSIF 3 searched for Ranger II on Orbit 14 during the visibility period commencing at 0430 GMT on November 19, 1961. The DSIF was secured after this pass. JPL, using information obtained from Ranger I, coarsely estimated that Ranger II would re-enter the Earth's atmosphere about 0400 GMT on November 19, 1961.

IV. TELEMETRY RECOVERY

A. General

The spacecraft signal was tracked for a total of about 30 minutes after injection during the first 5 orbits on the first day. The tracking coverage is listed in the following table which omits periods when the signal was lost in the middle of a pass.

TABLE II. TRACKING COVERAGE

<u>ORBIT</u>	<u>STATION</u>	<u>TRACKING PERIOD</u>	<u>REAL TIME TELEMETRY</u>
1	MTS (1)	0844 38-0850 56	Yes
	JOB (5)	0846 42-0846 56	No
	GLD (3)	0938 56-0944 46	"
	" (2)	0940 11-0940 21	"
	AMR (RFT rlr)	Approx. 0950	"
2	MTS (1)	1017 08-1023 39	Yes
	GLD (3)	1114 00-1116 11	No
3	MTS (1)	1150 25-1156 53	Yes
4	MTS (1)	1322 52-1328 05	Yes
	JOB (5)	1323 41-1329 08	Yes
5	MTS (1)	1456 29-1501 17	Yes

The longest station pass was $6\frac{1}{2}$ minutes for the 2nd and 3rd orbits over MTS. This station provided good engineering telemetry for all 5 passes tracked, usually managed to keep its decommutator synchronized for all rates, and had a very low rate of teletyping errors. It was necessary for the DRL to adjust their operation to reduce tapes in real time instead of 3.7 times real time as planned for a normal mission.

B. Engineering

1. Flight Temperatures

Temperature data was obtained from all engineering system transducers except the one in the Earth Sensor at least once during the five passes that Ranger II was tracked. No scientific temperatures are available at this time. Only four of those received were obtained twice. One of these, Solar Panel 4A-10, due to its low thermal inertia, fluctuates so rapidly with varying solar load that no useful information can be extracted from the data. The other three measurements obtained twice indicate the temperature rising with time. All other readings agree well with this trend, with the exception of the other solar panel. Temperatures in general are slightly higher than at corresponding times in the Ranger I flight primarily due to the low orbit giving greater aerodynamic heating. In addition, the spacecraft was probably tumbling, also tending to raise the temperature higher than at corresponding times in the Ranger I flight.

2. Friction Experiment

The following is known about the friction experiment on Ranger II flight:

- 1) The friction experiment was not running during the 4th pass over MTS at 1322 to 1328 GMT on 11/18/61.
- 2) Time for Command 10 to start friction experiment was 1419 GMT 11/18/61 between the 4th and 5th MTS pass.
- 3) During the 5th MTS pass at 1456 GMT 11/18/61, 25 good data points from the friction experiment were obtained.
- 4) Fortuitously one of the data points was a temperature code marker and 4 of the data points were readily comparable to data previously obtained from Ranger I flight.
- 5) This combination resulted in complete tentative identification and correlation of all of the 25 data points received.
- 6) It is our understanding that this is all of the data that can be obtained from this flight.

C. Scientific

1. Space Sciences

From the data received it appears that the cadmium sulfide detectors, low-energy triple coincidence telescope, and the geiger tubes operated normally. The DAS appeared to be functioning correctly with the possible exception of the frame-count register. Instruments which exhibited the same abnormal behavior as on Ranger I were the micrometeorite detector (spurious pulses, probably due to sunlight), the solar corpuscular radiation electrostatic analyzers (probably affected by the poor vacuum and the presence of the ionosphere), and the magnetometer (out of band due to high field of Earth). There are not yet enough data to analyze the performance of the ion chamber, the high-energy triple coincidence telescope, the gold-silicon detector, the Vela Hotel experiment, or the Lyman-alpha telescope.

The DAS went out of synch during launch sometime between 0814 48 and 0817 44.5 GMT, 18 November 1961.

V. SPACECRAFT PERFORMANCE

Engineering telemetry received by teletype from the DSIF during the abbreviated lifetime of Ranger II indicated that the spacecraft performed in a normal manner for a satellite orbit. The communications transponder and data encoder appeared to function normally. Even though no event blips were reported by the DSIF, most of the programmed controller commands were verified by other telemetry indicating that they occurred in the proper sequence within the scheduled time brackets. This confirmed electrical separation of the spacecraft from the Agena but mechanical separation could only be inferred at the time.

The attitude control power for both Sun and Earth acquisition was turned on between the first two passes over DSIF 1. For most of this period the spacecraft was in the Earth's shadow and no acquisition data was recovered. During the four sunlit passes tracked after that, position and rate data indicated no limit cycle operation. The spacecraft was probably tumbling much of the time in a manner similar to Ranger I, with Sun and Earth acquisition highly unlikely. This was further indicated by the very low values of solar panel current measured.

Indicated power consumption was slightly higher than expected which could be accounted for by the fact that the attitude control system requirements would be higher than normal when operating in the observed manner. In all probability the spacecraft was operating on battery power almost continuously.

The few temperature measurements which were obtained indicated that the spacecraft hex temperatures were rising with each orbit, just as would be expected.

The scientific instruments and friction experiment generally performed in a normal manner consistent with the orbit. There were some minor abnormalities indicated in the scientific experiments similar to those observed on Ranger I.

V. SPACECRAFT PERFORMANCE (CONT'D)

The command system was not tested on Ranger II. The quarter-watt transmitter signal was never tracked but antenna drive measurements indicated that it was operating normally.

Separation of the spacecraft from the Agena was confirmed by analysis of Agena telemetry, but the separation apparently was not normal. Magnetic tapes reduced by JPL's DRL after the flight confirmed most of the conclusions reported during the operation. Event channel blips were recovered from the first DSIF 1 pass indicating that the command for opening panels and boom was issued at the programmed time and that the commanded extensions took place. The only programmed controller command not verified was that for reducing the modulation on the beacon transmitter.